The Knee 22 (2015) 499–505

Contents lists available at ScienceDirect

The Knee

Posterolateral anatomical reconstruction restored varus but not rotational stability: A biomechanical study with cadavers☆,☆☆,★

Jose Wilson Serbino Junior [a], Roberto Freire da Mota Albuquerque [a,*], César Augusto M. Pereira [b], Márcia Uchôa de Rezende [a], Rodrigo Campos Pace Lasmar [a], Arnaldo José Hernandez [a]

[a] Orthopedics and Traumatology Department, University of Sao Paulo, Brazil
[b] Laboratory of Medical Investigation 41, Orthopedics and Traumatology Institute, Brazil

ARTICLE INFO

Article history:
Received 23 July 2014
Received in revised form 1 March 2015
Accepted 3 March 2015

Keywords:
Knee
Articular ligaments
Tendons
Joint instability
Biomechanical phenomena

ABSTRACT

Background and aim: Lesions to the posterolateral corner (PLC) of the knee are rarely isolated injuries, and they are potentially devastating, leading to progressive chondral injury, with important functional impairment. The objectives of this biomechanical study were to evaluate angular deformation with two loads and considering four flexion angles of the knee, varus and external rotation and in three situations of integrity, reconstruction and injury of posterolateral knee structures.
Methods: The posterolateral structures of 10 cadaveric knees were submitted to three biomechanical assays: in the "intact condition", "injured", and "reconstructed". The technique used for the reconstruction was the one proposed by LaPrade et al., but with autografts of hamstring tendons instead. A device was designed to apply loads of 2 and 5 N m, with zero, 30°, 60° and 90° of knee flexion, in varus or in external rotation, measuring angular deformation with photogoniometry.
Results: The anatomical reconstruction of the PLC proposed here did restore varus stability in all flexion angles ($p < 0.005$), but not rotational stability. External rotation deformation at 90° was similar in all test conditions. In knee extension, external rotation was stabilized only at 2 Nm. At 60°, external rotation was partially stabilized ($p < 0.05$).
Conclusions: The anatomical PLC reconstruction using hamstring tendons restored varus but not external rotational stability.
Clinical Relevance: The reconstruction of posterolateral corner injuries with autologous allografts is very important for regions were tissue banks are not available. This technique may be a first step to achieve this goal.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

Injuries to the posterolateral corner (PLC) of the knee have been described as the least frequent and the most neglected of knee lesions [1], but they have been better diagnosed in recent years [2]. These injuries are rarely isolated [3]: DeLee et al. [4] found 12 isolated injuries (1.6%) of the PLC in 735 patients treated with ligament injuries, and LaPrade et al. found 2.1% of patients with isolated injuries to the PLC [5]. Feng et al. [6] found 40% of peel-off femoral lesions in acute PLC injuries. In fact, the injuries of the PLC are usually associated with other ligament injuries, such as the anterior cruciate ligament (ACL) or posterior cruciate ligament (PCL) tears, as well as tibial plateau fractures [1,3,7–9].

Despite being rare, lesions of the PLC of the knee are potentially devastating, leading to progressive chondral injury, with important functional impairment [10,11]. Posterolateral rotatory instability is a result of rupture or loosening of structures that form the lateral aspect of the knee, leading to posterior dislocation and external rotation of the lateral tibial plateau with respect to the femur [12]. The fibular collateral ligament (FCL), the popliteus tendon (PoT), the popliteofibular ligament (PFL) and the posterolateral corner capsular structures can be involved [9,13].

☆ Ethical Review Committee statement: This study was approved by the Ethics Committee of Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, number CAPPesp 000884/2009.

☆☆ This study was developed in Faculdade de Medicina da Universidade de São Paulo (FMUSP).

★ JWSJr, RFMA and CAS participated in the study design, data collection, data interpretation, wrote and revised the final version of the manuscript. RL and AJH participated in the study design, data collection and interpretation, and revised the final version. MUR participated in the data collection and interpretation, wrote the manuscript and revised the final version of the manuscript.

* Corresponding author at: Orthopedics and Traumatology Department, Faculdade de Medicina da Universidade de São Paulo, Rua Dr. Ovídio Pires de Campos, 333 Cerqueira Cesar, São Paulo, (SP) CEP: 05403-010, Brazil, . Tel.: +55 11 99608 3660.
E-mail address: rmotaa@uol.com.br (R.F.M. Albuquerque).

http://dx.doi.org/10.1016/j.knee.2015.03.001
0968-0160/© 2015 Elsevier B.V. All rights reserved.

Undiagnosed and untreated lesions to the posterolateral corner structures can lead to ACL and PCL surgical treatment failures [2,9,14,15]. However, complaints in patients with PLC lesions are not characteristic, making the diagnosis difficult [1]. These are also injuries necessitating complex treatment [14,18]. Surgery is a frequent choice of treatment, but there are many surgical techniques described, with no consensus on which is more adequate [1,7–11,13,14,18–20].

LaPrade et al. [8] have published, in 2004, a technique of anatomical reconstruction of the FCL, PoT and PFL in cadavers with no capsule injury. Varus stability and external rotation stability were achieved. Achilles tendons showed to be strong and resistant, but these kinds of allografts are not widely available in many countries, such as ours (Brazil), where tissue banks are not organized in all regions, requiring surgeons to search for autograft options. Achilles tendons are thus excluded in clinical practice and the semitendinosus and gracilis tendon grafts emerge as alternatives.

Besides, in our experience, trauma to the PLC corner of the knee often involve a ruptured capsule. Instability of the PLC capsular structures occur because of injuries to the posterolateral capsule and also to the FCL, PoT and PFL in the clinical setting.

This scenario inspired us to develop the present study, in which our objective was to evaluate biomechanically the reconstruction of FCL, PoT and PFL, with the surgical technique described by LaPrade [8], but using autografts of semitendinosus and gracilis tendons, in cadaveric specimens with an injured posterolateral joint capsule.

2. Materials and methods

2.1. Study design, ethics and specimens

This was an experimental study with cadavers, a biomechanical assay undertaken in the Laboratory of Medical Investigations 41 (LIM-41) — Faculdade de Medicina da Universidade de São Paulo (FMUSP). The Local Ethics Committee previously approved the protocol, and the specimens used were obtained from the city's coroner service.

The convenience sample was composed of eight cadavers (10 knees) from male individuals who died without lower limb trauma or degenerative disease, aged 34 to 70 years old (average of 53.8 years). The eight cadavers provided six right knees and four left knees (two cadavers were bilaterally studied).

The knees had no evidence of injuries or instability, as observed by manual examination and by dissection immediately before experimentation. The only exception, as described below, was one knee, which presented with a meniscal lesion. This specimen was maintained in the study.

In all the knee specimens, the femur was sawn 15 cm from the joint and the tibia at 20 cm from the articular line, and the skin was sectioned at the same level. The knees were stored at −20 °C [2,8,21,22] for a maximum of two months until biomechanical testing.

The specimens were defrosted 12 h prior to the biomechanical assays, at room temperature, in sodium chloride solution (at 0.9%). Anteroposterior and varus–valgus examination was performed prior to the biomechanical assay, with Lachman and posterior drawer tests (at 30° and 90°). The semitendinosus and gracilis tendons were removed and prepared as grafts with polyester 5 sutures (Fig. 1). Both knees and grafts were wrapped in clothes imbibed in 0.9% sodium chloride solution until testing. Graft length and diameter were not measured.

The proximal fibula was fixed to the tibia by a cortical screw (4.5 mm in diameter) that crossed a plastic cylinder, maintaining the relationship between the two bones and function of proximal tibiofibular syndesmosis [23–27], and the fibula was sectioned 2.5 cm distal to this screw. The specimen was then potted in bone cement (inside the plastic cylinder).

The knees were tested in the following order: uninjured, reconstructed and injured situations.

2.2. Summary of ligaments addressed

ACL	Anterior cruciate ligament
FCL	Fibular collateral ligament
PCL	Posterior cruciate ligament
PFL	Popliteofibular ligament
PLC	Lesions to the posterolateral corner
PoT	Popliteus tendon

2.3. Surgical technique

Immediately before the ligament reconstruction, the semitendinosus and gracilis tendon grafts were tensioned for 20 min at 20 N, by 2 kg traction in one of the extremities.

All bony tunnels were drilled over K wires and were 7 mm in diameter. Tibial and fibular tunnels were drilled through the midpoints of their attachment sites (Fig. 2). Fibular tunnel was drilled from the lateral aspect of the fibular head to the posteromedial fibular styloid. The tibial tunnel was drilled in an anteroposterior direction from the posterior popliteal tibial sulcus to a point just distal and medial to Gerdy's tubercle exiting at the posterior tibial popliteal sulcus. Two parallel femoral tunnels were drilled from the popliteus tendon and fibular collateral ligament attachment sites on the femur, aiming them anteromedially through the distal femur. They exited the distal femur proximo-medial to the medial epicondyle and adductor tubercle.

The semitendinosus graft was used to reconstruct the fibular collateral ligament and the popliteofibular ligament. The gracilis was used to substitute the popliteal tendon. All ligaments were fixed with polyester 5 (Ethibond®) over bicortical screw and washer (tibia and femur) while a cannulated interference screw was used in the fibular tunnel [Figs. 3 and 4].

2.4. Experimental device

A device was specially developed to measure the precise angular displacement of the knee when submitted to moments of force in different flexion angles. The device was composed of a table with a metal frame whose function was to fix, position and apply moments of force to the knee through weights, pulleys and lever arms.

The knee was fixed to the device by means of two tubular holders. The femoral holder fixed the femoral diaphysis (Fig. 5O) and the other fixed the tibial diaphysis (Fig. 5H). To ensure proper alignment and fixation of the tibia, it was previously inserted into the vinyl polychloride pipe filled polymetilmethacrylate (PMMA) (Fig. 5F), which was then placed into the tibial holder (Fig. 5H).

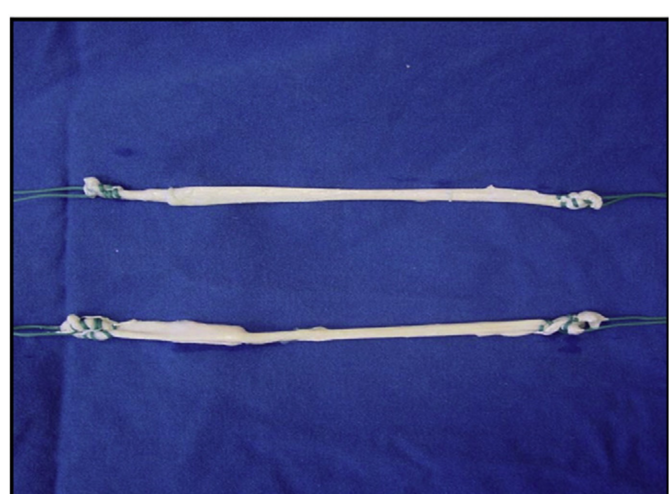

Fig. 1. Semitendinosus and gracilis tendon grafts prepared.

Download English Version:

https://daneshyari.com/en/article/4077353

Download Persian Version:

https://daneshyari.com/article/4077353

Daneshyari.com